

Tutvedt Gravel Extraction Operation Traffic Impact Study 2020 Update Kalispell, Montana

A. EXECUTIVE SUMMARY

The current level of truck use at the Tutvedt gravel pit site is below the original estimates from 2008 and the proposed batch plant will add a relatively small amount of new traffic onto the road system under normal conditions. The current traffic volumes within this area are relatively low and the nearby intersections are operating with minimal operational delay. Overall traffic volumes in this area have not changed significantly over the last ten years. The Tutvedt gravel pit currently has only one access onto Farm to Market Road. The gravel pit has received approval for an additional access onto Church Drive, but this approach has not yet been constructed. The current vehicle crash rates on most of the area roadways are at or below the statewide average. The intersection of Reserve Drive and West Valley Drive has a known crash concentration that was identified in 2008 but is not significantly impacted by the gravel extraction operations. No additional traffic mitigation measures are recommended at this time for the changes to the Tutvedt Gravel Extraction Operation.

B. PROJECT DESCRIPTION

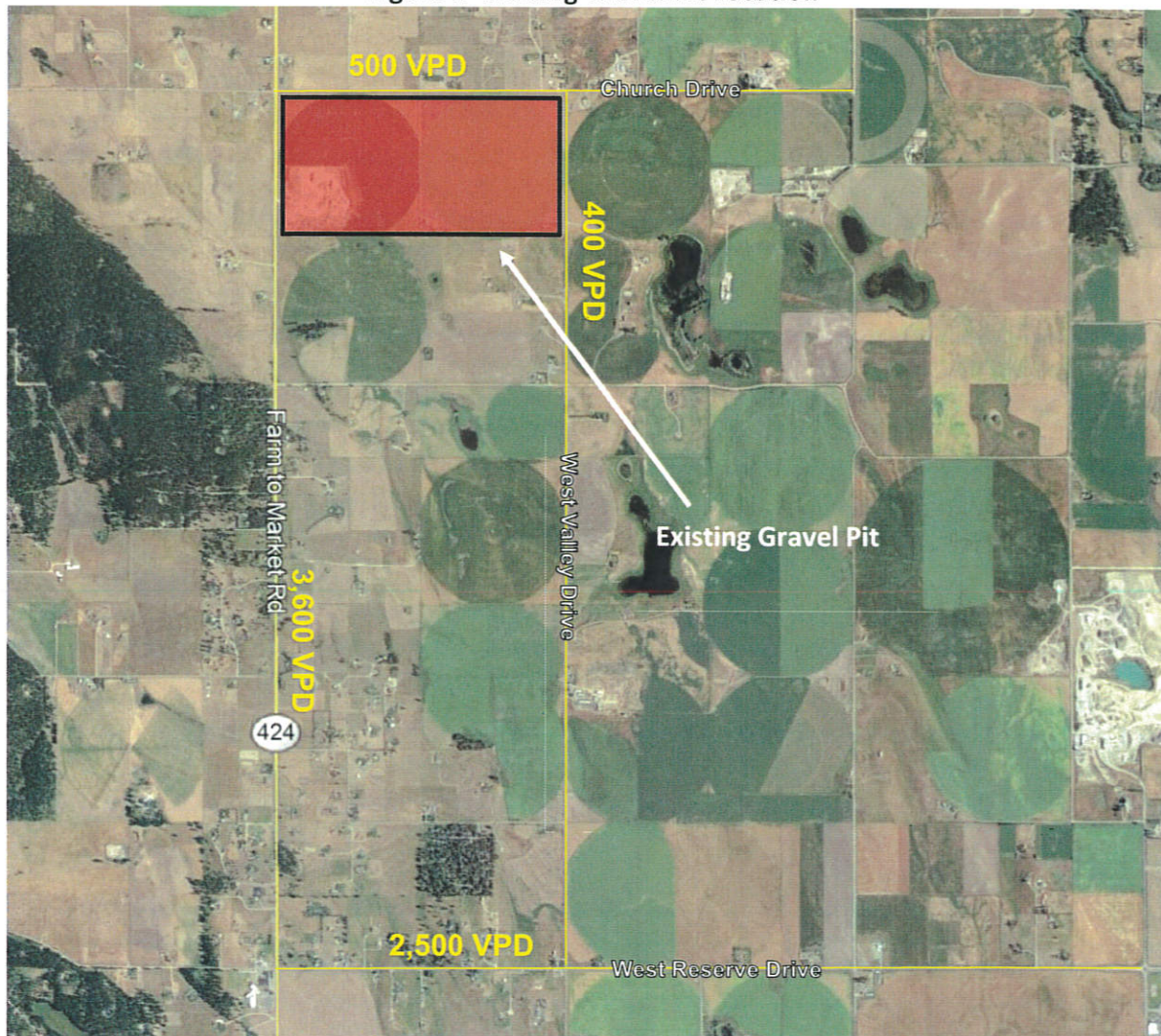
This document provides an update to the current and planned operations at the 320-acre Tutvedt gravel extraction operation northwest of Kalispell, Montana. The document identifies traffic changes which have occurred in this area since 2008 and identifies any traffic mitigation efforts that should be performed as a result of the new operational plans for the gravel pit. The site is located to the east of MT Secondary 424 and south of Church Drive. Gravel extraction operations began at this location in July 2006.

C. EXISTING CONDITIONS

The areas surrounding the gravel pit are comprised of rural farmland and residential properties. Access to the gravel pit is provided via a single access onto S-424 (Farm to Market Road) 1,700 feet south of Church Drive. The gravel pit currently operates year-round and averages 45 loads per day. See **Figure 1** for a location map of the existing gravel pit.



Figure 1- Existing Gravel Pit Location



Adjacent Roadways

MT Secondary 424 (Farm to Market Road) is a two-lane highway which provides access to the areas to the northwest of Kalispell. The roadway has a rural cross-section and a paved width of 26 feet with two 11-foot wide travel lanes on 120 feet of right-of-way. The roadway has a posted speed limit of 55 MPH. The West Valley School is located adjacent to the highway just south of S-548 (West Reserve Drive). The highway is posted with a 45 MPH speed limit approaching the school property and a 25 MPH variable speed limit which activates during the pick-up and drop-off periods. The roadway currently carries 3,600 VPD north of West Reserve Drive.

MT Secondary 548 (West Reserve Drive) is a two-lane roadway which extends along the northern edge of the City of Kalispell. The western end of this roadway has a rural cross-section and a paved width of 24 feet with two 12-foot wide travel lanes on 60 feet of right-of-way. The roadway has a posted speed limit of 55 MPH. East of Stillwater Road the highway has been fully reconstructed to current urban standards. The highway currently carries 2,500 VPD east of Farm to Market Road.

Church Drive is a two-lane east/west County maintained roadway. The roadway has a rural cross-section and a paved width of 22 feet on 50 feet of right-of-way. The road has a posted speed limit of 35 MPH. The roadside environment is comprised mostly of farm and ranch properties land with some rural residential homes along the north side of the road. East of West Valley Drive the roadway passes through several sharp curves which were reconstructed to improve truck turning movements by the Tutvedt gravel pit. The roadway currently carries 500 VPD east of Farm to Market Road.

West Valley Drive is a two-lane north/south County maintained roadway which extends south from Church Drive. The roadway has a rural cross-section and a paved width of 22 feet on 50 feet of right-of-way. The roadway has a posted speed limit of 35 MPH. The roadside environment is comprised mostly of farm and ranch land with numerous rolling hills. The intersection of West Valley Drive and West Reserve Drive is controlled by STOP signs with warning flashers along West Valley Drive. The roadway currently carries 400 VPD south of Church Drive.

Traffic Counts

In order to determine how traffic volumes on these roads have changed in the last ten years Abelin Traffic Services gathered historic Average Daily Traffic (ADT) volumes for Farm to Market Road and West Reserve Drive from MDT. Flathead County also collected traffic count data from Church Drive and West Valley Drive on a semi-annual basis until 2014. This data is presented in **Table 1**. The data indicates that over the last ten years the traffic volumes on these roads have increased at an annual average growth rate 0.5%, which is lower than the average traffic volume growth rate for the Kalispell area. This level of traffic volume growth indicates that overall traffic volumes and traffic patterns in this area have not changed significantly in the last ten years. Based on this information, the traffic data collected for the original project in 2008 was factor by 6% to more accurately represent 2020 traffic volume conditions on the study roadways. The traffic data collected in 2008 includes turning movement counts at critical intersections around the gravel pit and 24-hour direction hose counts along Church Drive and West Valley Drive. Although the gravel pit was not in operation at this time, this traffic data provided a good assessment of the background traffic volumes in this area without the heavy truck traffic from the extraction operations. The raw traffic data is included in **Appendix A** of this report.

Table 1 –Historic Average Daily Traffic Data

Location	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Farm to Market Rd. N. of Reserve Drive	3,150	3,090	3,440	3,480	2,820	2,940	3,100	2,993	2,981	2,999	2,966	3,603
Reserve Drive E. of Farm to Market Rd.	1,970	1,930	2,240	2,270	2,470	2,570	2,470	2,240	2,217	2,272	2,247	2,495
Church Drive E. of Farm To Market *	390	-	-	-	427	-	-	-	-	-	-	-
West Valley Dr. S. Church Dr.*	404	-	618	-	442	-	-	-	-	-	-	-

*No traffic data collected by Flathead County after 2014

Level of Service

Using the data collected for this project, ATS conducted a Level of Service (LOS) analysis at area intersections. This evaluation was conducted in accordance with the procedures outlined in the Transportation Research Board's *Highway Capacity Manual (HCM) - Special Report 209* and the Highway Capacity Software (HCS) version 7.8. Intersections are graded from A to F representing the average delay that a vehicle entering an intersection can expect. Typically, a LOS of C or better is considered acceptable for peak-hour conditions.

The critical traffic impacts on the intersections and roadways in this area occur during the weekday morning and evening peak hours when background traffic volumes in the area are highest. ATS also performed a special analysis of the traffic volumes at the intersection of Farm to Market Road and West Reserve Drive to correspond with the afternoon school traffic at West Valley School.

Table 2 – 2020 Traffic Level of Service Summary Without Gravel pit

Intersection	AM Peak Hour		PM Peak Hour	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Farm to Market Road & Church Drive**	10.0/10.2	A/B	9.3/9.7	A/A
Farm to Market Road & West Reserve Drive**	17.0/23.5	C/C	12.3/15.7*	B/C*
West Valley Drive & Church Drive	8.8	A	8.8	A
West Valley Drive & West Reserve Drive**	10.8/15.1	B/C	13.6/15.4	B/C

*PM Period School Release.

**Eastbound/Westbound or Northbound/Southbound Side Street LOS & Delay.

Table 2 shows the 2020 LOS for area intersections without the traffic from the gravel pit based on the factored traffic data collected in 2008. The LOS calculations are included in **Appendix**

B. The table shows that all the intersections within the study area are currently operating within acceptable levels under average annual daily traffic conditions.

D. EXISTING SITE OPERATIONS

The Tutvedt gravel pit began operations at the existing site in June 2006. The pit operates year-round with peak usage between May and October. Gravel extraction operations occur between 7:00 AM to 7:00 PM Monday thru Friday and 7:00 AM to 2:00 PM on Saturdays. The gravel pit generally has three employees on-site and currently averages 45 loads of gravel per day. The current usage is less than the 75 daily loads estimated in 2008 for the original traffic study for this project.

Access to the site is currently provided by one driveway connection onto Farm to Market Road 1,700 feet south of Church Drive. This access has unlimited site distances in both directions and has appropriate warning signs. The gravel pit has received approval for an additional access onto Church Drive, but this approach has not yet been constructed.

ATS assessed the conditions imposed by the Flathead County Planning Office which related to traffic from the original 2008 Conditions of Approval and 2010 Settlement Agreement. These agreements have been met. The conditions set by the planning board which applied to traffic were:

Condition 16- "Signage shall be erected to alert vehicular and pedestrian traffic to the presence of heavy truck travel along all travel routes, including Farm to Market Road, Church Drive, West Reserve Drive, Stillwater Drive, and West Valley Drive." - The appropriate signage has been installed and maintained on these routes.

Condition 19- "The applicant shall obtain and furnish proof of an approach permit from the Flathead County Road and Bridge Department for the access onto Farm to Market Road and abide by any conditions regarding dust abatement and maintenance." - This approach has been approved and constructed.

E. TRIP GENERATION AND ASSIGNMENT

ATS performed a trip generation analysis to determine the existing traffic volumes from the gravel pit under the current use conditions. This analysis was performed using the daily haul records for the gravel pit from 2019 and 2020. The gravel pit currently records how many loads are extracted from this site each day, whether the gravel was commercially purchased or part of the company operations, and for which construction project the gravel was intended. The number of daily loads at the site ranged from 1 to 118 loads with an average of 45 loads per day. This information is based on 190 days of operations data for the site over the last two years. The average daily traffic from the site was calculated to be 90 VPD for gravel trucks (45 loads x 2) plus an additional six

trips for employees (96 total daily trips). Generally gravel loads are distributed evenly throughout the day from 7:00 AM to 7:00 PM with slightly higher traffic in the mornings and less traffic in the evenings. For the purposes of this study it was estimated that the peak use times have approximately 10% of the daily total. Therefore, the average daily trip generation for this site is 96 trips with 10 trips during the peak hours.

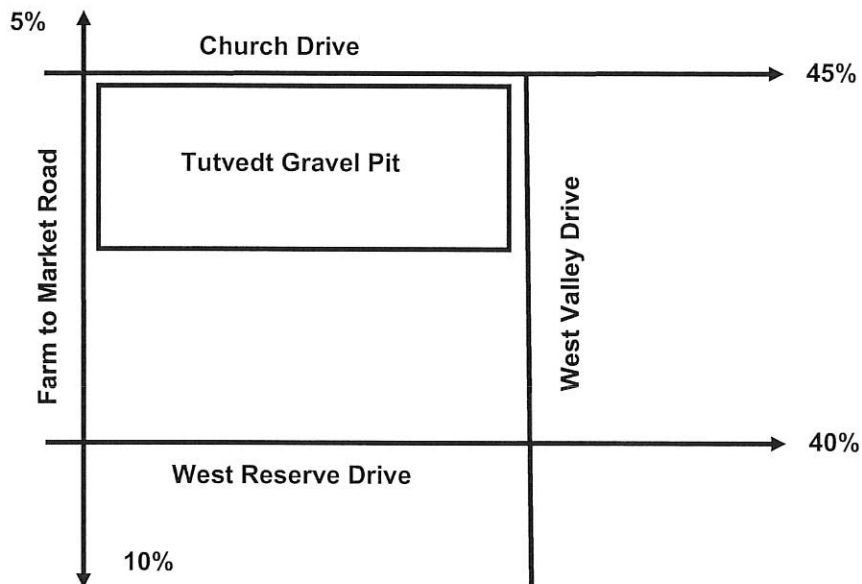
The information prepared by the Montana Department of Environmental Quality (DEQ) in 2006 indicated that the site should produce 82 trip per day based on the estimated gravel extraction rates for the site and employee vehicle traffic. These numbers are in line with the current average trip generation from the gravel pit.

The new asphalt batch plant would add an additional six trips per day to the site on average. Special large projects could produce up to 166 daily trips at peak operating conditions, but these special projects will be of limited duration (5-10 days) and will likely occur less than once a year. With the batch plant, the total average daily vehicle trip generation at the site will be approximately 102 vehicle trips per day and the peak hourly trip rate will remain at 10 trips per hour.

F. TRIP DISTRIBUTION

The traffic distribution and assignment for the gravel pit subdivision was based upon the existing use trends for the area from the operations records. Based on the historic trends is expected that truck traffic will continue to distribute 45% to/from the east on Church Drive, 5% to/from the north on Farm to Market Road, 10% to/from the south on Farm to Market Road, and 40% to/from the east on West Reserve Drive. This trip distribution is shown on **Figure 2**. Leaving the area trucks can distribute into the greater Flathead valley from major intersections at Church Drive/Highway 93 (separated overpass), West Reserve Drive (roundabout at Stillwater Road and traffic signals at the Highway 93 bypass), and Three Mile Drive (traffic signals at the Highway 93 bypass)

Figure 2 – Trip Distribution



G. TRAFFIC IMPACTS

Using the trip generation and trip distribution numbers, ATS determined the Level of Service for the area intersections with the traffic from the gravel pit including the new batch plant. These calculations are based on the projected model volumes included in **Appendix A** of this report.

**Table 3 – 2020 Level of Service Summary
With Gravel Pit Traffic**

Intersection	AM Peak Hour		PM Peak Hour	
	Delay (Sec.)	LOS	Delay (Sec.)	LOS
Farm to Market Road & Church Drive**	10.0/10.4	A/B	9.3/9.8	A/A
Farm to Market Road & West Reserve Drive**	17.2/23.6	C/C	12.4/15.8	B/C
West Valley Drive & Church Drive	8.8	A	8.8	A
West Valley Drive & West Reserve Drive**	10.8/15.3	B/C	13.6/15.5	B/C

*PM Period School Release.

**Eastbound/Westbound or Northbound/Southbound Side Street LOS & Delay.

Table 3 indicates that the daily operations of the Tutvedt gravel pit has little effect on the traffic conditions within the area. The truck traffic generated by the gravel pit increases the total traffic at the area intersections by approximately five vehicles per hour (1-3% increase). The proposed batch plant will increase traffic by only one vehicle per hour on average. The total additional vehicle delay caused by truck traffic at the study intersections is less than one second per vehicle. All area intersections function at the same LOS with the truck traffic from the gravel pit. Truck traffic from the gravel pit does not affect the overall operational characteristics of these roadways.

H. Turn Lane Needs

ATS reviewed the left- and right-turn lane warrants for the intersections along Farm to Market Road and West Reserve Drive based on the requirement from the *MDT Road Design Manual*. This analysis showed that left-turn deceleration lanes are not currently necessary at these intersections. The new proposed uses at the site will not produce sufficient traffic to require additional lane improvements. The turn-lane warrant calculations are shown in **Appendix C**.

I. Crash Data

ATS reviewed data from the MDT online vehicle crash database for the roadways around the proposed development to determine if any vehicle crash concentrations could be identified in this area within the last five years. The vehicle crash numbers and rates from the MDT database are shown in **Table 4**. In general, most rural intersections have an average vehicle crash rate of 0.5-1.5 crashes per Million Vehicles Entering (MVE). Most of the intersections included in this study have a crash rate in this range and do not indicate any specific crash trend or crash concentration.

A total of 12 crashes have occurred along West Reserve Drive at the West Valley Drive intersection in the last five years and the crash rate at this intersection is higher than the normal rate for rural intersections (2.2/MVE). The crash trends at this intersection were identified in the 2008 traffic report for the gravel pit. This intersection warrants further study to determine why crashes continue to occur at this location. This crash trend is an existing condition that does not have any known relation to the current operations at the gravel pit. The gravel pit contributes less than 2% to the traffic at this location and is not a major contributor of these crashes.

Table 4 – Vehicle Crashes 2015-2019

Intersection	Recorded Crashes	Crash Rate (Per MVE)
Farm to Market Road & Church Drive	3	0.4
Farm to Market Road & West Reserve Drive	7	0.8
West Valley Drive & Church Drive	2	1.2
West Valley Drive & West Reserve Drive	12	2.2

J. IMPACT SUMMARY & RECOMMENDATIONS

The current traffic volumes within this area are relatively low and the nearby intersections are operating with minimal operational delay. Overall traffic volumes in this area have not changed significantly over the last ten years. The Tutvedt gravel pit currently has only one access onto Farm to Market Road. The gravel pit has received approval for an additional access onto Church Drive, but this approach has not yet been constructed. The current vehicle crash rates on most of the area roadways are at or below the statewide average. The intersection of Reserve Drive and West Valley Drive has a known crash concentration that was identified in 2008 but is not significantly impacted by the gravel extraction operations. No additional traffic mitigation measures are recommended at this time for the changes to the Tutvedt Gravel Extraction Operation.

APPENDIX A

Traffic Model

Tutvedt Gravel Pit
Traffic Model
Existing 2020 AM
Peak Hour Traffic

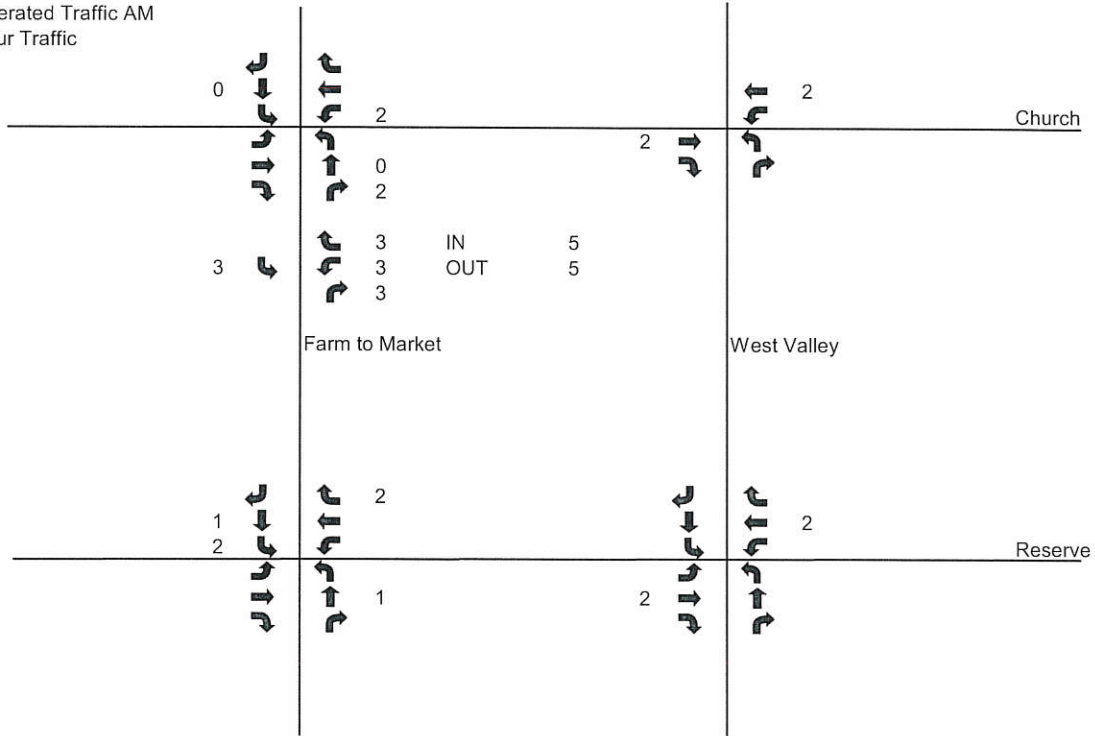
		10.0/10.2 A/B		8.8 A	
2008 Growth Factor 1.06	1	3			
	158	2		10	
	7	8		10	Church
	5	8	29	4	
	5	56	19	8	
	11	8			
		Gravel Pit			
		Farm to Market		West Valley	
		17.0/23.5 C/C		10.8/15.1 B/C	
	8	30	2	6	
	211	18	18	78	
	129	55	52	12	Reserve
	3	14	1	0	
	46	70	229	4	
	39	78	3	36	

Tutvedt Gravel Pit
Traffic Model
Existing 2020 PM
Peak Hour Traffic

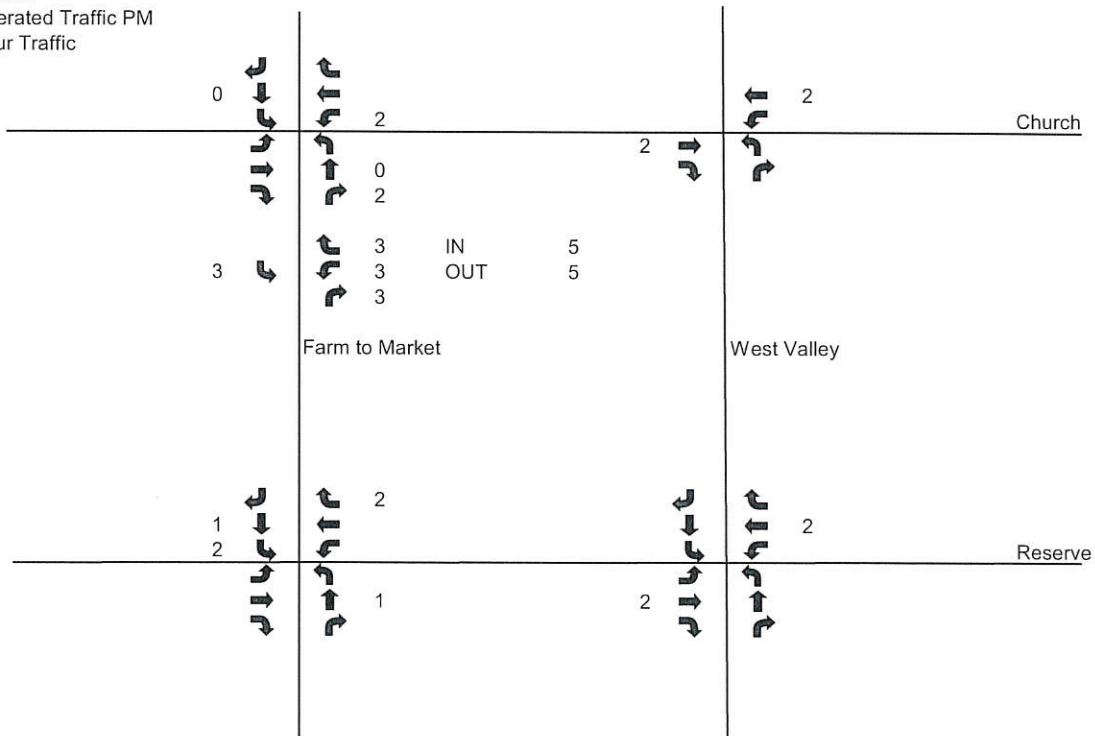
		9.3/9.7 A/A		8.8 A	
	1	10			
	65	8		15	
	2	4		11	Church
	0	10	22	8	
	3	101	1	5	
	7	2			
		Gravel Pit			
		Farm to Market		West Valley	
		12.3/15.7 B/C		13.6/15.4 B/C	
	4	58	1	49	
	99	24	11	186	
	47	73	16	39	Reserve
	2	30	0	3	
	24	126	103	34	
	19	78	3	20	

*Afternoon School Release Period

Tutvedt Gravel Pit
 Traffic Model
 Site Generated Traffic AM
 Peak Hour Traffic



Tutvedt Gravel Pit
 Traffic Model
 Site Generated Traffic PM
 Peak Hour Traffic



APPENDIX B

LOS Calculations

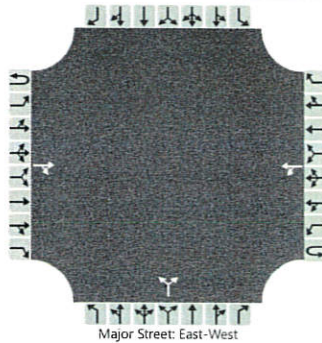
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & West Valley
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	West Valley Drive
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			30	19		10	10			4		8				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type Storage					Undivided											

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						13					16					
Capacity, c (veh/h)						1550					979					
v/c Ratio						0.01					0.02					
95% Queue Length, Q ₉₅ (veh)						0.0					0.0					
Control Delay (s/veh)						7.3					8.7					
Level of Service (LOS)						A					A					
Approach Delay (s/veh)						3.7					8.7					
Approach LOS											A					

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HCS7 Two-Way Stop-Control Report

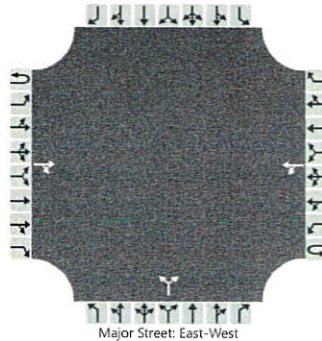
General Information

Analyst	RLA
Agency/Co.	ATS
Date Performed	7/27/2020
Analysis Year	2020
Time Analyzed	PM Peak Hour
Intersection Orientation	East-West
Project Description	Tutvedt Gravel Pit

Site Information

Intersection	Church & West Valley
Jurisdiction	Flathead County
East/West Street	Church Drive
North/South Street	West Valley Drive
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			22	1		11	15			8		5				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type Storage																

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

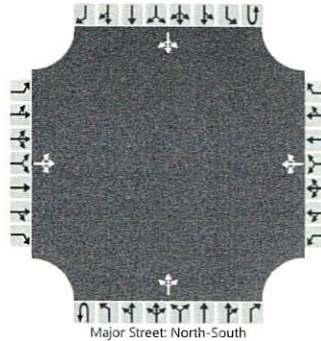
Flow Rate, v (veh/h)						15				17						
Capacity, c (veh/h)						1595				966						
v/c Ratio						0.01				0.02						
95% Queue Length, Q ₉₅ (veh)						0.0				0.1						
Control Delay (s/veh)						7.3				8.8						
Level of Service (LOS)						A				A						
Approach Delay (s/veh)						3.1				8.8						
Approach LOS										A						

HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	5	11		8	2	3		8	56	8		7	158	1
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

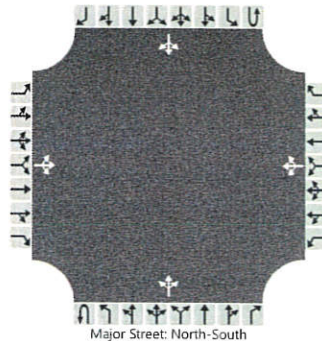
Flow Rate, v (veh/h)			24				15			9				8		
Capacity, c (veh/h)			744				701			1409				1541		
v/c Ratio			0.03				0.02			0.01				0.01		
95% Queue Length, Q ₉₅ (veh)			0.1				0.1			0.0				0.0		
Control Delay (s/veh)			10.0				10.2			7.6				7.3		
Level of Service (LOS)			A				B			A				A		
Approach Delay (s/veh)	10.0				10.2				0.9				0.3			
Approach LOS	A				B											

HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	3	7		4	8	10		10	101	2		2	65	1
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage					Undivided											

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			12				25				11				2	
Capacity, c (veh/h)			855				789				1538				1486	
v/c Ratio			0.01				0.03				0.01				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.1				0.0				0.0	
Control Delay (s/veh)			9.3				9.7				7.4				7.4	
Level of Service (LOS)			A				A				A				A	
Approach Delay (s/veh)	9.3				9.7				0.7				0.2			
Approach LOS	A				A											

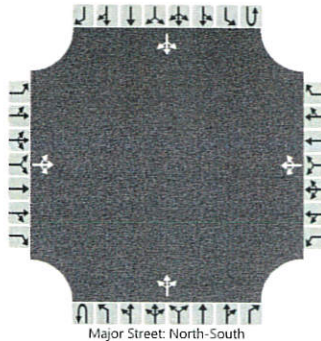
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Reserve & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	West Reserve Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	AM Peak Hour	Peak Hour Factor	0.85
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	46	39		55	18	30		14	70	78		129	211	8
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

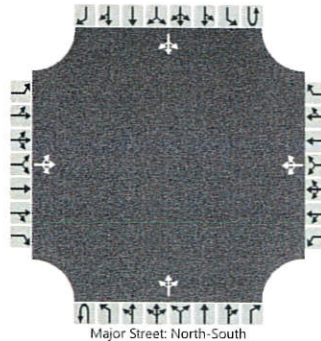
Flow Rate, v (veh/h)			104				121				16				152	
Capacity, c (veh/h)			402				314				1319				1415	
v/c Ratio			0.26				0.39				0.01				0.11	
95% Queue Length, Q ₉₅ (veh)			1.0				1.8				0.0				0.4	
Control Delay (s/veh)			17.0				23.5				7.8				7.9	
Level of Service (LOS)			C				C				A				A	
Approach Delay (s/veh)	17.0				23.5				0.8				3.5			
Approach LOS	C				C											

HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Reserve & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	West Reserve Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	PM Peak Hour	Peak Hour Factor	0.85
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		2	24	19		73	24	58		30	126	78		47	99	4
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			53				182				35				55	
Capacity, c (veh/h)			544				518				1479				1339	
v/c Ratio			0.10				0.35				0.02				0.04	
95% Queue Length, Q ₉₅ (veh)			0.3				1.6				0.1				0.1	
Control Delay (s/veh)			12.3				15.7				7.5				7.8	
Level of Service (LOS)			B				C				A				A	
Approach Delay (s/veh)	12.3				15.7				1.1				2.7			
Approach LOS	B				C											

HCS7 Two-Way Stop-Control Report

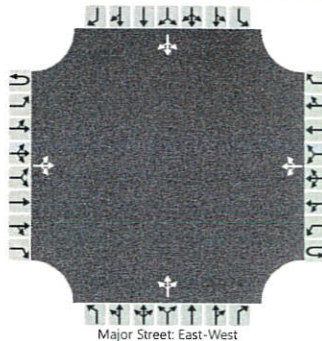
General Information

Analyst	RLA
Agency/Co.	ATS
Date Performed	7/28/2020
Analysis Year	2020
Time Analyzed	AM Peak Hour
Intersection Orientation	East-West
Project Description	Tutvedt Gravel Pit

Site Information

Intersection	Reserve & West Valley
Jurisdiction	Flathead County
East/West Street	West Reserve Drive
North/South Street	West Valley Drive
Peak Hour Factor	0.71
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	229	3		12	78	6		1	4	36		52	18	2
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type Storage																

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1				17					58				101	
Capacity, c (veh/h)		1482				1244					679				456	
v/c Ratio		0.00				0.01					0.09				0.22	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.3				0.8	
Control Delay (s/veh)		7.4				7.9					10.8				15.1	
Level of Service (LOS)		A				A					B				C	
Approach Delay (s/veh)		0.0				1.1					10.8				15.1	
Approach LOS											B				C	

HCS7 Two-Way Stop-Control Report

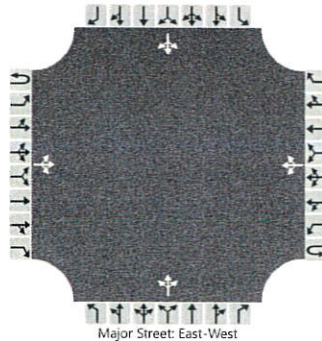
General Information

Analyst	RLA
Agency/Co.	ATS
Date Performed	7/28/2020
Analysis Year	2020
Time Analyzed	PM Peak Hour
Intersection Orientation	East-West
Project Description	Tutvedt Gravel Pit

Site Information

Intersection	Reserve & West Valley
Jurisdiction	Flathead County
East/West Street	West Reserve Drive
North/South Street	West Valley Drive
Peak Hour Factor	0.71
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	103	3		39	186	49		3	34	20		16	11	1
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type Storage							Undivided									

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1				55					80				39		
Capacity, c (veh/h)		1240				1444					500				386		
v/c Ratio		0.00				0.04					0.16				0.10		
95% Queue Length, Q ₉₅ (veh)		0.0				0.1					0.6				0.3		
Control Delay (s/veh)		7.9				7.6					13.6				15.4		
Level of Service (LOS)		A				A					B				C		
Approach Delay (s/veh)	0.1					1.4				13.6				15.4			
Approach LOS										B				C			

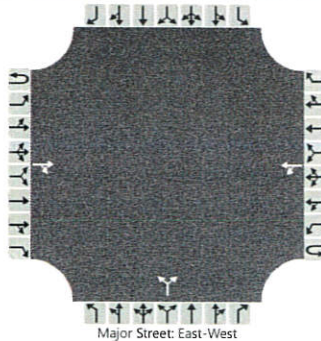
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & West Valley
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	West Valley Drive
Time Analyzed	AM Peak With Gravel Pit	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			31	19		10	12			4		8				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						13					16					
Capacity, c (veh/h)						1548					976					
v/c Ratio						0.01					0.02					
95% Queue Length, Q ₉₅ (veh)						0.0					0.0					
Control Delay (s/veh)						7.3					8.8					
Level of Service (LOS)						A					A					
Approach Delay (s/veh)					3.4				8.8							
Approach LOS									A							

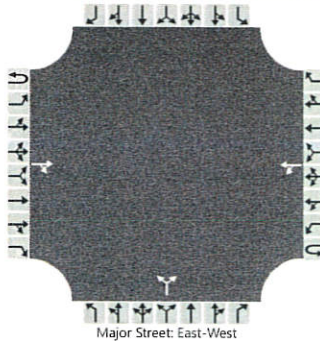
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & West Valley
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	West Valley Drive
Time Analyzed	PM Peak With Gravel Pit	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			25	1		11	17			8		5				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type Storage																

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						15					17					
Capacity, c (veh/h)						1590					959					
v/c Ratio						0.01					0.02					
95% Queue Length, Q ₉₅ (veh)						0.0					0.1					
Control Delay (s/veh)						7.3					8.8					
Level of Service (LOS)						A					A					
Approach Delay (s/veh)						2.9					8.8					
Approach LOS											A					

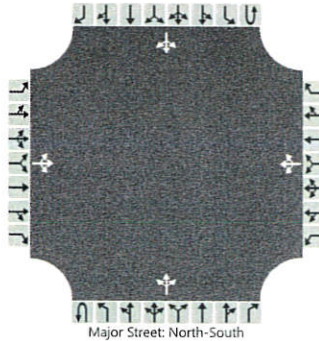
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	AM Peak With Gravel Pit	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	5	11		11	2	3		8	56	11		7	158	1
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			24				18				9				8	
Capacity, c (veh/h)			743				689				1409				1537	
v/c Ratio			0.03				0.03				0.01				0.01	
95% Queue Length, Q ₉₅ (veh)			0.1				0.1				0.0				0.0	
Control Delay (s/veh)			10.0				10.4				7.6				7.4	
Level of Service (LOS)			B				B				A				A	
Approach Delay (s/veh)	10.0				10.4				0.9				0.4			
Approach LOS	B				B											

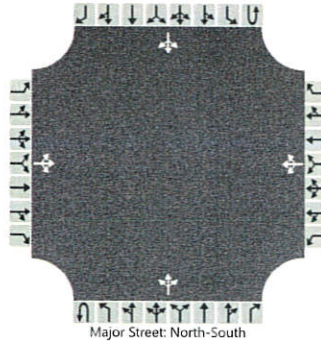
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Church & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	Church Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	PM Peak With Gravel Pit	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	3	7		6	8	10		10	101	4		2	65	1
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

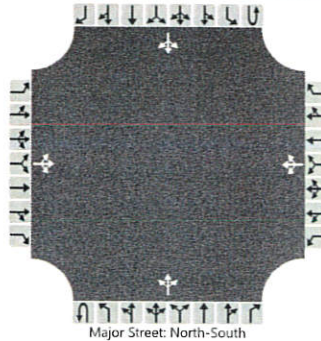
Flow Rate, v (veh/h)			12				27				11				2	
Capacity, c (veh/h)			854				782				1538				1483	
v/c Ratio			0.01				0.03				0.01				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.1				0.0				0.0	
Control Delay (s/veh)			9.3				9.8				7.4				7.4	
Level of Service (LOS)			A				A				A				A	
Approach Delay (s/veh)	9.3				9.8				0.7				0.2			
Approach LOS	A				A											

HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Reserve & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	West Reserve Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	AM Peak With Gravel Pit	Peak Hour Factor	0.85
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	46	39		55	18	32		14	70	78		131	211	8
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

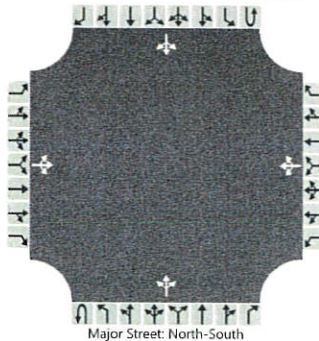
Flow Rate, v (veh/h)			104				124				16				154	
Capacity, c (veh/h)			399				316				1319				1415	
v/c Ratio			0.26				0.39				0.01				0.11	
95% Queue Length, Q ₉₅ (veh)			1.0				1.8				0.0				0.4	
Control Delay (s/veh)			17.2				23.6				7.8				7.9	
Level of Service (LOS)			C				C				A				A	
Approach Delay (s/veh)	17.2				23.6				0.8				3.6			
Approach LOS	C				C											

HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Reserve & Farm to Market
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/27/2020	East/West Street	West Reserve Drive
Analysis Year	2020	North/South Street	Farm to Market Road
Time Analyzed	PM Peak With Gravel Pit	Peak Hour Factor	0.85
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		2	24	19		73	24	60		30	127	78		49	99	4
Percent Heavy Vehicles (%)		0	0	0		0	0	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.50	6.20		7.10	6.50	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.00	3.30		3.50	4.00	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			53				185			35				58		
Capacity, c (veh/h)			539				516			1479				1337		
v/c Ratio			0.10				0.36			0.02				0.04		
95% Queue Length, Q ₉₅ (veh)			0.3				1.6			0.1				0.1		
Control Delay (s/veh)			12.4				15.8			7.5				7.8		
Level of Service (LOS)			B				C			A				A		
Approach Delay (s/veh)	12.4				15.8				1.1				2.8			
Approach LOS	B				C											

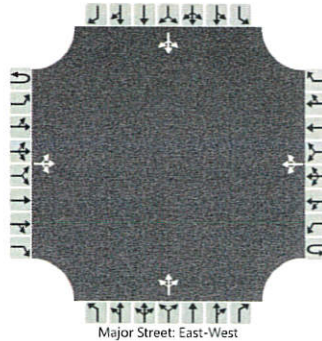
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Reserve & West Valley
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/28/2020	East/West Street	West Reserve Drive
Analysis Year	2020	North/South Street	West Valley Drive
Time Analyzed	AM Peak With Gravel Pit	Peak Hour Factor	0.71
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	231	3		12	80	6		1	4	36		52	18	2
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized																
Median Type Storage							Undivided									

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1				17					58				101		
Capacity, c (veh/h)		1479				1241					676				452		
v/c Ratio		0.00				0.01					0.09				0.22		
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.3				0.9		
Control Delay (s/veh)		7.4				7.9					10.8				15.3		
Level of Service (LOS)		A				A					B				C		
Approach Delay (s/veh)	0.0					1.1				10.8				15.3			
Approach LOS										B				C			

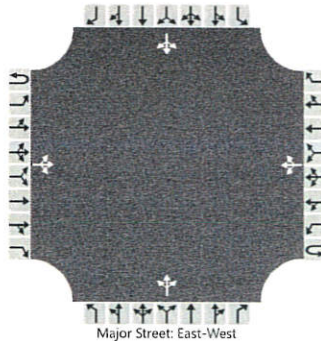
HCS7 Two-Way Stop-Control Report

General Information

Analyst	RLA	Intersection	Reserve & West Valley
Agency/Co.	ATS	Jurisdiction	Flathead County
Date Performed	7/28/2020	East/West Street	West Reserve Drive
Analysis Year	2020	North/South Street	West Valley Drive
Time Analyzed	PM Peak With Gravel Pit	Peak Hour Factor	0.71
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tutvedt Gravel Pit		

Site Information

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		1	105	3		39	188	49		3	34	20		16	11	1
Percent Heavy Vehicles (%)		0				0				0	0	0		0	0	0
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type Storage					Undivided											

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.10				4.10				7.10	6.50	6.20		7.10	6.50	6.20
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.20				2.20				3.50	4.00	3.30		3.50	4.00	3.30

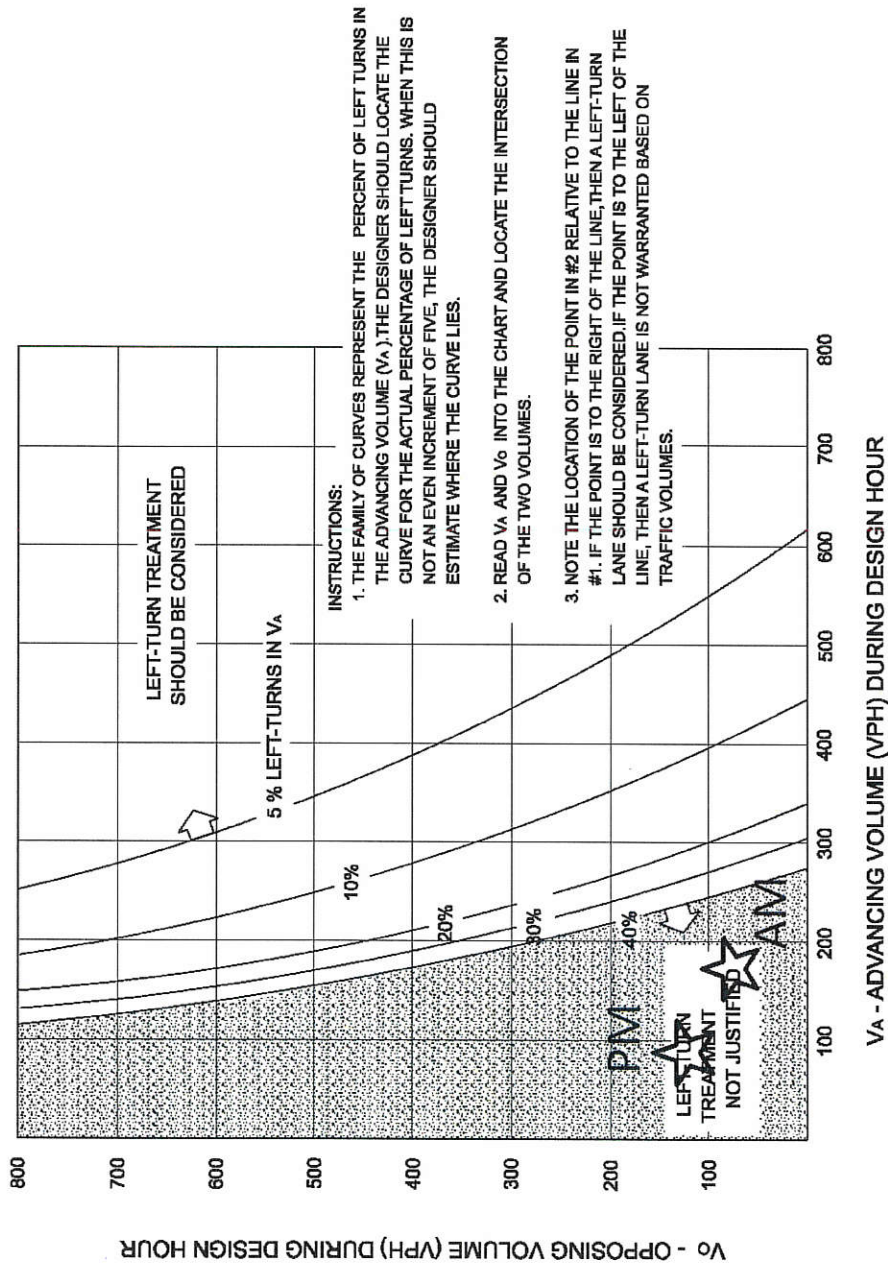
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1				55					80				39	
Capacity, c (veh/h)		1237				1441					497				383	
v/c Ratio		0.00				0.04					0.16				0.10	
95% Queue Length, Q ₉₅ (veh)		0.0				0.1					0.6				0.3	
Control Delay (s/veh)		7.9				7.6					13.6				15.5	
Level of Service (LOS)		A				A					B				C	
Approach Delay (s/veh)	0.1				1.4				13.6				15.5			
Approach LOS									B				C			

APPENDIX C

Turn- Lane Warrants

Tutvedt Gravel Pit Approach 2020



VOLUME GUIDELINES FOR LEFT-TURN LANES AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS 55 mph (90 km/h)

Figure 13.3D